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Alison Robertson
Iowa State University, alisonr@iastate.edu

Charlie Hurburgh
Iowa State University, tatry@iastate.edu

Lisa Shepherd
Iowa State University

Charlie Block
Iowa State University

Roger Elmore
Iowa State University, relmore@iastate.edu

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Goss's wilt: Get the facts

Alison Robertson, associate professor and Extension plant pathologist, Plant Pathology, Iowa State University; Charlie Hurburgh, professor, Agricultural and Biosystems Engineering, Iowa State University; Lisa Shepherd, assistant scientist, Seed Science Center, Iowa State University; Charlie Block, assistant professor, Plant Pathology; Roger Elmore, professor and Extension corn agronomist, Agronomy, Iowa State University

Goss's wilt and leaf blight is caused by the bacterium *Clavibacter michiganensis* subsp. *nebraskense* (Cmn). Historically, this disease has been a concern only to growers in western Nebraska and eastern Colorado on irrigated fields. In 2008, Goss's wilt was reported in eight counties in Iowa and its prevalence has increased each year. In 2011, the disease was widespread throughout the central and northern two thirds of Iowa. It was also reported in a few counties in the southern third tier of counties. Why the sudden increase in the prevalence of this disease? Has the pathogen changed? Are various production practices to blame? Is seed contaminated with the bacterium? There are many questions concerning this disease.

Disease cycle

The primary source of inoculum for Goss's wilt is Cmn-infested corn residue. The bacterium can survive at least 10 months in surface residue. Dissemination of the bacterium from the residue to corn has not been studied but it is hypothesized the bacterium is splashed dispersed onto the leaves of young corn seedlings. Smidt and Vidaver (1986) isolated Cmn from the surfaces of apparently healthy corn plants in early June, and populations of the bacterium on the leaves increased throughout the growing season. Physical damage to the plant by hail, wind or sand is necessary for infection by the bacterium, and all plant parts can be infected. Unlike Stewart's wilt, insects are not known to be involved with spread of the disease or infection and disease development. The optimum temperature for disease development is approximately 80F.

Another source of inoculum may be seed, since the bacterium is seedborne and can be seed transmitted at very low rates (0.1-0.4% in inoculated seed).

Symptoms

Goss's wilt symptoms may be easily mistaken for other diseases including northern leaf blight, Stewart's wilt and drought or heat stress. In Iowa, Goss's wilt usually appears soon after silking as leaf blight symptoms in the top canopy of the plant. Lesions are large, grey to reddish and start at the tips of the leaves and extend downwards, often along the edge of the leaf. Cigar-shaped lesions may also occur away from the edge of the leaf. Rather than a distinct delimitation between diseased and healthy tissue (like with northern leaf blight), the border of Goss's wilt lesions is usually indistinct and may be grey-green. Within this "border", the characteristic freckles associated with Goss's wilt are seen. The freckles are one of the characteristic symptoms that MUST be used to correctly diagnose this disease. The bacterium often oozes out of lesions and dries on the surface of the leaf as shiny exudates. This exudate is often more visible on the underside of the leaf.

When the pathogen infects the vascular system of the plant, wilting can occur. This symptom is less common. Discoloration of a few bundles in the vascular system may occur together with a wet, slimy stalk rot.

Goss's wilt test kits

Agdia® (www.agdia.com) sells 'dipstick' tests for *C. michiganensis* subsp. *michiganensis*, a tomato pathogen, that cross react with Cmn. These test kits can be a useful tool for making a preliminary diagnosis of Goss's wilt. However, false positives can and do occur. The tests are very sensitive and it is possible to cross contaminate samples (Tamra Jackson, UNL, Personal communication). The tests can also cross react with saprophytic organisms, for example, those associated with purple sheath blight.

Races of Cmn

A race is defined as a subgroup or biotype within a species that can be distinguished from other races by virulence, symptom expression, or host range, but not by morphology (D'Arcy et al., 2001). Usually, a set of differentials (range of plant cultivars) are used to define races of plant pathogens based on known susceptible and resistant reactions. There is no such set of differentials for Cmn. Recently, Agarkova et al (2011) evaluated the genetic diversity of 131 strains of Cmn collected from 1969 through 2009 with two molecular methods. The population separated into two groups, A and B. Interestingly, Group B (13 strains) contained only strains collected from after 1999. This study indicates that there may be some genetic changes occurring in this pathogen; however the changes could not be related to pathogenicity or the recent disease spread. A second study is currently away at the University of Nebraska-Lincoln to further evaluate these findings.

Hosts of Cmn

A small number of plant species are susceptible to Cmn. Shuster (1975) isolated Cmn from green foxtail and shattercane in corn fields in Nebraska. He also artificially inoculated a number of diverse species with Cmn. Only shattercane, grain sorghum, sudangrass and sugarcane were susceptible to infection.

Foliar applied products for Goss's management

Procidic, a broad spectrum fungicide and bactericide, is the only product currently labeled to control Goss's wilt for use in Iowa. The active ingredient in Procidic is citric acid. There is no published data available on the efficacy of this product. In other bacterial pathosystems, copper-based products are often used, such as Kocide®. Since this product is currently not labeled for use on corn to manage Goss's, it should not be used. Korus et al. (2010) evaluated Kocide® 3000 and Headline® for Goss's wilt control on two hybrids (one susceptible and one resistant) in Nebraska in 2009. The trial was inoculated with the Goss's wilt bacterium at growth stage V6/V7. Treatments were applied six days before inoculation, four hours after inoculation or 24 hours after inoculation. Goss's wilt disease was slightly reduced on a susceptible hybrid with an application of Kocide 24 hours after inoculation, but no differences in yield were detected between this treatment and the untreated, inoculated control. On the resistant hybrid, no treatment differences were detected.

Greenhouse trials are currently underway to assess the effect of some products and results may be shared at the ICM Conference.

Goss's wilt and grain quality

During the 2011 growing season, eight fields in central Iowa and one field in southwest Iowa with Goss's wilt were identified for a preliminary study to assess the impact of the disease on grain quality. In each field, during late August/early September, 20 plants (two rows of 10 consecutive plants) with no Goss's wilt symptoms were tagged. At a nearby location in the field, where Goss's leaf blight symptoms were evident, another 20 plants were tagged and disease severity estimated. Just prior to harvest, ears were hand harvested from the tagged plants. Stalk rot severity was assessed using the University of Illinois scale on six of the 20 tagged plants. Row number and kernel length were assessed for each ear. Ear samples from each location sent to the ISU Grain Quality Laboratory to be shelled and grain quality characteristics (test weight, moisture, seed size, protein, starch, etc.) were assessed. Dry grain samples were sent to the ISU Seed Science Center for assessment of seed borne incidence of Cmn, and seed transmission studies. Results of this study will be shared at the ICM conference.

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